Report No. NAWCADWAR-93050-60

EVALUATION OF THE HUGHES CONVERSION COATING TOUCH-UP PEN

John Deitzel* and Stephen J. Spadafora

Aerospace Materials Division
Air Vehicle and Crew Systems Technology Department (Code 6062)
NAVAL AIR WARFARE CENTER
AIRCRAFT DIVISION
P.O. Box 5152
Warminster, PA 18974-0591

(* Jaylords Inc.
1080 N. Delaware Ave
Philadelphia, PA 19125)

22 July 1993

FINAL REPORT

Approved for Public Release; Distribution is Unlimited

Prepared for
NAVAL AIR SYSTEMS COMMAND (AIR-09Y3B)
Washington, DC 22202

NOTICES

REPORT NUMBERING SYSTEM — The numbering of technical project reports issued by the Naval Air Warfare Center, Aircraft Division, Warminster is arranged for specific identification purposes. Each number consists of the Center acronym, the calendar year in which the number was assigned, the sequence number of the report within the specific calendar year, and the official 2-digit correspondence code of the Functional Department responsible for the report. For example: Report No. NAWCADWAR-92001-60 indicates the first Center report for the year 1992 and prepared by the Air Vehicle and Crew Systems Technology Department. The numerical codes are as follows:

CODE	OFFICE OR DEPARTMENT
00	Commanding Officer, NAWCADWAR
01	Technical Director, NAWCADWAR
05	Computer Department
10	AntiSubmarine Warfare Systems Department
20	Tactical Air Systems Department
30	Warfare Systems Analysis Department
50	Mission Avionics Technology Department
60	Air Vehicle & Crew Systems Technology Department
70	Systems & Software Technology Department
80	Engineering Support Group
90	Test & Evaluation Group

PRODUCT ENDORSEMENT — The discussion or instructions concerning commercial products herein do not constitute an endorsement by the Government nor do they convey or imply the license or right to use such products.

Reviewed By: Arthur Fletcher **Date:** 12-20-93
Branch Head

Reviewed By: [signature] **Date:** 12/22/93
Division Head

Reviewed By: [signature] **Date:** 12/27/93
Director/Deputy Director

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	22 July 1993	Final JAN 1993 - JUN 1993

4. TITLE AND SUBTITLE
EVALUATION OF THE HUGHES CONVERSION COATING TOUCH-UP PEN

5. FUNDING NUMBERS

6. AUTHOR(S)
John Deitzel and Stephen J. Spadafora

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Vehicle and Crew Systems Technology Department (Code 6062)
NAVAL AIR WARFARE CENTER
AIRCRAFT DIVISION
P.O. Box 5152
Warminster, PA 18974-0591

8. PERFORMING ORGANIZATION REPORT NUMBER
NAWCADWAR-93050-60

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
NAVAL AIR SYSTEMS COMMAND (AIR-09Y3B)
1213 Jefferson Davis Highway
Crystal Gateway 4, Suite 1414
Arlington, VA 22202

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution is Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Chromate conversion coatings are common surface pretreatments for aluminum substrates on Navy aircraft, weapon platforms and ground support equipment. While this chromated process performs satisfactorily, future restrictions require the elimination or minimization of chromium emissions from this process. One approach to minimize emissions is through the incorporation of new touch-up procedures. A chemical film Touch-Up Pen developed by Hughes Ground Systems Group offers potential to provide the required paint adhesion and corrosion protection for aluminum for repair applications. The Naval Air Warfare Center Aircraft Division at Warminster performed a study of this pen and the following is a description of the evaluation.

14. SUBJECT TERMS
Inorganic Coatings
Conversion Coatings
Organic Coatings
Surface Pretreatments
Envirinmentally Compliant Materials

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Chromate conversion coatings (CCC) are common surface pretreatments for aluminum substrates on Navy aircraft, weapon platforms and ground support equipment. This process forms an oxide film which provides both corrosion protection and enhances the adhesion of subsequent coating systems. MIL-C-81706 "Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys" describes the material performance requirements of CCC. MIL-C-5541 "Chemical Conversion Coatings on Aluminum and Aluminum Alloys" describes the performance requirements of oxide film produced by the CCC. While this chromated process offers satisfactory performance, future restrictions necessitate the elimination or minimization of chromium emissions from this process.

One approach to minimize emissions is through the incorporation of new touch-up procedures. Hughes Ground Systems Group has developed a patented pending chemical film Touch-Up Pen (TUP) that provides both paint adhesion and corrosion protection for aluminum during repair applications. Hughes claims the benefits of this pen include an estimated 1000:1 hazardous material usage reduction, faster material application rates, little to no clean-up and little to no disassembly required. The Naval Air Warfare Center Aircraft Division at Warminster performed a study of this pen and the following is a description of the evaluation.

EXPERIMENTAL

The performance of the TUP and CCC processes was evaluated on common aluminum alloys and with standard Navy coating systems. Physical performance tests (i.e. bare and painted corrosion resistance, coating adhesion, coating weights, etc.) were used to evaluate the oxide films. The investigation was performed in two phases. The first phase covered the performance properties of the TUP chemical film as a sole pretreatment, and the second phase addressed the compatibility of the TUP with previously pretreated CCC panels. The following is a description of the substrates, coatings, experimental procedures, and results from this investigation.

PHASE I

Processing

2024-T3 aluminum alloy test panels (3" x 6") were used as the base metal for the first phase of the investigation. These panels were processed using the following procedure:

A. Solvent wipe panels with MEK
B. Alkaline Clean (Turco's 4215 NC-LT non-silicated & non-Cr
C. Deionized water rinse
D. Desmut in Turco's Smut-Go-NCB (Non-Cr deoxidizer)
E. Deionized water rinse
F. Apply pretreatments

Five pretreatments were used to form MIL-C-81706/MIL-C-5541 Chromate Conversion Coating Films.

1. Hughes Touch Up Pen (wiped)*
   (Manufacturer's recommended procedure).
2. Brush on Alodine 1200 (sponge stick)
3. Wipe-on Alodine 1200 (Scotch bright pad)
4. Dip Alodine 1200 (control process)
5. Hughes Touch Up Pen (w/o wiping)*

* A problem was noted in the processing with the TUP. The tips of the markers routinely fell out of the pens during application to the panels. This situation needs to be resolved before these pens could be used in-service.

Coating Weight Determination

Coating weights of the conversion coating films were obtained using the test procedure outlined in MIL-C-81706. Weights for each process were determined on 2024-T3 Aluminum alloy and were recorded in mg/ft^2. A minimum coating weight of 40 mg/ft^2 is specified by MIL-C-71706. Table 1 shows the weights obtained for the different pretreatments.

TABLE 1. Coating Weights for the Pretreatments

PROCESS	COATING WEIGHT (mg/sq.ft.)
Hughes Touch Up Pen (wiped)	20.26
Brush on Alodine 1200 (sponge)	50.64
Wipe-on Alodine 1200 (pad)	52.00
Dip Alodine 1200 (control)	37.04
Hughes Touch Up Pen (w/o wiping)	32.80

Bare Corrosion Resistance

Five aluminum specimens of each pretreatment system were exposed in a 5% NaCl salt spray corrosion chamber (ASTM B-117) for 336 hours and examined for evidence of corrosion at 24, 48, 72, 144, 240, and 336 hours. A summary of the evaluation is provided in Table 2. The Alodine 1200 pretreatment process on all specimens passed 336 hours of exposure without any evidence of surface corrosion, indicating excellent system performance. The Hughes Touch Up Pen (wiped and without wiping) specimens, however, began to show signs of corrosion after 48 hours of exposure. They both failed after 72 hours of exposure with heavy corrosion evident over the entire surface of the panel. This showed poor bare pretreatment performance and is unacceptable for areas not painted.

TABLE 2. 5% NaCl - Salt Spray Results for Unpainted Panels

Pretreatment 48 Hour Test Results

Hughes Touch Up Pen (wiped)	Moderate corrosion (90%)#
Brush on Alodine 1200	No surface corrosion
Scotch Pad on Alodine 1200	No surface corrosion
Regular Dip on Alodine 1200	No surface corrosion
Hughes Touch Up Pen (w/o wiping)	Moderate corrosion (60%)#

Pretreatment 72 Hour Test Results

Hughes Touch Up Pen (wiped)	Very Heavy corrosion (100%)#
Brush on Alodine 1200	No surface corrosion
Scotch Pad on Alodine 1200	No surface corrosion
Regular Dip on Alodine 1200	No surface corrosion
Hughes Touch Up Pen (w/o wiping)	Very Heavy corrosion (90%)#

Percentage of surface corroded

Note: All of the Alodine 1200 pretreatment processes passed 336 hours with no surface corrosion.

Painted Performance

The five pretreatment processes were evaluated for performance with organic coatings. Table 3 lists the specifications and thicknesses for the organic finishing systems used in this study.

TABLE 3: ORGANIC COATINGS SPECIFICATIONS

1. MIL-P-23377D, Type 1 "Primer Coatings, Epoxy Polyamide, Chemical and Solvent Resistant." Film thickness: 15.2 to 22.9 microns (0.0006 to 0.0009 inches).

2. MIL-P-85582A, Type 1 "Primer Coatings: Epoxy, Waterborne." Film thickness: 15.2 to 22.9 microns (0.0006 to 0.0009 inches).

3. TT-P-2756, "Polyurethane Coating: Self-Priming Topcoat, Low Volatile Organic Compound (VOC)." Film thickness: 50.8 to 55.9 microns (0.0020 to 0.0022 inches).

The above coatings were applied by conventional air spray and were allowed to cure for seven days prior to testing.

Adhesion and Water Resistance

Adhesion of organic coating systems to the conversion coating films was evaluated using a wet tape adhesion test. The wet tape test is a modified version of the American Society for Testing and Materials ASTM D 3359, Method A. This test was performed by immersing a specimen in distilled water for a period of time at a specific temperature. Three immersion conditions were used for

this test: 24 hours at 23°C, 96 hours at 49°C, and 168 hours at 65°C. Upon removal, two parallel scribes, 3/4 inch apart, were cut through the coating and into the substrate. An "X" was subsequently scribed through the coating between the two initial scribes. A strip of 3M 250 masking tape was applied firmly to the coating surface perpendicular to the scribe lines and immediately removed with one quick motion. The specimens were examined for removal and uplifting of the coating from the substrate and the adhesion rating was recorded. Table 4 gives the performance description for these adhesion ratings. In addition, the water resistance of the pretreatment/coating systems was characterized by examining the test panels for softening, uplifting, blistering, and other coating defects and substrate corrosion which may have resulted from the exposure.

TABLE 4 ASTM #D-3359 Adhesion Ratings

Rating	Description
5A	No peeling or removal
4A	Trace peeling or removal along incisions
3A	Jagged removal along incisions, up to 1/16 inch (1.6mm) on either side of the incisions.
2A	Jagged removal along most of incisions, up to 1/8 inch (3.2mm) on either side of incisions.
1A	Removal from most of the area of the "X" under the tape
0A	Removal beyond the area of the "X" (scribed)

Enhanced coating adhesion is one of the primary functions of a surface pretreatment. These tests were performed after the 7 day cure time for the coatings. With further aging of the finishing system, adhesion normally improves, so these results are considered the minimum values. Excellent adhesion results were obtained for all of the Alodine 1200 processed treatment with the various coating systems as shown in Table 5. These pretreatment systems also exhibited excellent water resistance which is evidenced by no blistering of the coating systems and the tape test results after extended immersion in water. The Hughes Touch-Up Pen (wiped) showed excellent results with MIL-P-23377 as far as adhesion and water resistance test. The panels with MIL-P-85582 had good adhesion, however, they failed the water resistance tests with No. 4 (medium) and No. 6 (few) blisters as rated by ASTM Method D 714. The TUP/TT-P-2756 systems passed water resistance, but failed the 24 hour adhesion test with a 2A. The 96 hours test was 5A, and the 168 hours test was a 3A which is passing. The Hughes Touch-Up Pen (not wiped) had excellent to good results with the adhesion test, but they all failed the water resistance test with No.4, 6,and 8 (few to medium) blisters on all test panels. These results are not unexpected, since the Hughes procedure indicated that the surface must be wiped with a damp cloth to remove excess coating in order to enhance adhesion of subsequent coatings.

TABLE 5 Adhesion/Water Resistance Test Results

2024-T3 Al/ Process	Coating weight mg/ft	MIL-P-23377 wet tape (24*)	wet tape (96)	wet tape (168)	MIL-P-85582 wet tape (24)	wet tape (96)	wet tape (168)	TT-P-2756 wet tape (24)	wet tape (96)	wet tape (168)
Hughes TUP (wiped)	20.26	5A	5A	5A	3A#	4A	5A#	2A#	5A	3A#
Alodine (Brush)	50.64	5A	5A	5A	4A	5A	5A	4A#	5A	4A#
Alodine (Wipe)	52.00	5A	5A	5A	5A	5A	5A	4A#	5A	5A
Alodine (Dip)	37.04	5A	5A	5A	5A	5A	5A	4A#	5A	4A#
Hughes TUP (w/o wipe)	32.80	5A#	5A#	5A#	3A#	5A#	5A#	3A#	4A#	4A#

* hours immersion in deionized distilled water
# Indicates that panel blistered (failed water resistance)

Painted Corrosion Resistance

Corrosion resistance is an important property for Navy Aircraft coatings due to the severe operational environment in which the aircraft are deployed. Therefore, most aircraft primer specifications have a minimum of 1000 hours exposure to salt spray as the corrosion resistance requirement. The pretreatment plays an integral role in meeting this requirement by maintaining the integrity of the coating/substrate interface. To evaluate this property, painted specimens for the five pretreatment systems were exposed to 5% NaCl Salt Spray (ASTM #B-117) for 2000 hours. These specimens were scribed with a figure "X" through the coating and into the substrate. The panels were inspected for corrosion in the scribe area and blistering of the coating across the surface. A summary of the evaluation is provided in Table 6. The Hughes Touch-Up Pen (not wiped) failed at 500 hours with all three coating systems. These results were expected because of the bare panel results. The Touch-Up Pen (wiped) with MIL-P-85582 passed with only slight white corrosion after 2000 hours, and TT-P-2756 passed with slight to medium white corrosion present. However, it failed with MIL-P-23377 at 1500 hours because of some blistering in the scribe area. All three Alodine process panels with all three coating systems passed 2000 hours with no corrosion or very slight scribe corrosion. These results indicate a deficiency with the film produced by the Touch-Up Pen alone.

TABLE 6. 5% NaCl Salt Spray Results for Painted Panels

MIL-P 23377 (Pretreatments)	500 Hours	1000 Hours	1500 Hours	2000 Hours	Pass/Fail >2000 hrs
Hughes TUP (wiped)	N/C*	N/C	Some #4+ N/C	Some #4 Slight C.	Failed
Alodine (Brush)	N/C	N/C	N/C	N/C	Passed
Alodine (Wipe)	N/C	N/C	N/C	N/C	Passed
Alodine (Dip)	N/C	N/C	N/C	Slight C.	Passed
Hughes TUP (w/o wiping)	Small #8 med. N/C	Same N/C	#4&#8 N/C	Same w/ a few pits in scribe (Slt-Med C)	Failed
MIL-P-85582					
HUGHES TUP (wiped)	N/C	N/C	N/C	Slt-Med C.	Passed
Alodine (Brush)	N/C	N/C	N/C	Slt-Med C.	Passed
Alodine (Wipe)	N/C	N/C	N/C	N/C	Passed
Alodine (Dip)	N/C	N/C	N/C	N/C	Passed
Hughes TUP (w/o wiping)	Small #8 Med. N/C	Same	Many #8 Med. N/C	Same w/ a few pits in scribe & Slt C.	Failed
TT-P-2756					
Hughes TUP (wiped)	Very slt corr.	Same	Same	Slight to Med. C.	Passed
Alodine (Brush)	Very slt. corr.	Same	Same	Slight corr.	Passed
Alodine (wipe)	Very slt corr.	Same	Same	Same	Passed
Alodine (Dip)	Very slt corr.	Same	Same	Same	Passed
Hughes TUP (w/o wiping)	Small #8 Med. very slight C.	Same	Many #8 Med. very slight C.	Many #6&#8 (medium) slight C.	Failed

(* N/C = No Corrosion, C. = Corrosion, + = type of blisters)

PHASE II

Processing

2024-T3 Aluminum Alloy (3"X6") panels, pretreated with Alodine 1200 Chromate Conversion Coating (CCC), were obtained from Q Panel Inc. These panels were used as the substrate for the second phase of this effort. An area 1" X 2 1/2" on each panel was damaged with a Scotch Brite Pad to remove the Alodine film down to the bare Aluminum substrate. This was to simulate a defect area on an aircraft. These damaged areas were repaired using the Hughes Touch-Up Pen and Brush On Alodine 1200 Process as the control. The following is a description of the repair process.

A. Removed CCC with Scotch Brite Pad from 1" X 2 1/2" area.
B. Solvent wipe test panels with MEK.
C. Perform Water-Break test to assure a clean surface.
D. Pretreat to meet MIL-C-81706/MIL-C-5541 Requirements.
    1. Hughes Touch-Up Pen (wiped process)
    2. Brush On Alodine 1200 Repair Process

Bare Corrosion Resistance

Five aluminum specimens of each pretreatment system were exposed in 5% Salt Spray (ASTM B-117) for 336 hours. These were examined for evidence of corrosion at 24 hours, 48 hours, 72 hours, 96 hours, 192 hours, 240 hours, and 336 hours. Both treatment systems passed to 336 hours. The test was continued and the Hughes Touch-Up Pen lasted 548 hours while the Brush On Alodine went over 1000 hours. This improved performance over the TUP alone showed that the CCC present around the prepared area, aided the Hughes Touch-Up Pen in the bare corrosion resistance test.

Painted Performance

The performance of several organic coatings was evaluated over the two pretreatment processes. These coatings were applied by conventional air spray and allowed to cure for seven days prior to testing. The same coating systems and thicknesses as those in Phase I were utilized.

Adhesion and Water Resistance

The adhesion of organic coating systems to the pretreated specimens was evaluated using the Wet Tape Adhesion Test. This is the modified version of the ASTM D 3359, Method A used in Phase I. The results of the adhesion and water resistance tests are presented in Table 7. The Brush On Alodine process exhibited both excellent adhesion and water resistance results with all three coating systems. The Hughes Touch-Up Pen panels, however, showed a compatibility problem where the TUP coating overlapped the Q Panel Film coating area. Both primer coatings blistered and failed in this area. The TT-P-2756 coating system provided fair results in both areas indicating that this paint system is more forgiving to this condition.

TABLE 7 Adhesion/Water Resistance Test Results

MIL-P-23377 Pretreatment	wet tape 24 hrs.	wet tape 96 hrs.	wet tape 168 hrs.
Brush On Alodine	5A	5A	5A
Touch Up Pen	4A	5A	4A
Outside Area TUP	2A#	1A#	2A#
MIL-P-85582 Pretreatment			
Brush On Alodine	5A	5A	5A
Touch Up Pen	4A	0A#	4A
Outside Area TUP	1A#	0A#	2A# (No.8-Dense)
TT-P-2756 Pretreatment			
Brush On Alodine	5A	4A#	4A#
Touch Up Pen	5A	4A#	4A#
Outside Area TUP	4A#	4A#	4A#

# indicates that panels blistered (i.e. failed water resistance)

Painted Corrosion Resistance

Corrosion resistance was evaluated by exposing repaired panels to 5% NaCl Salt Spray (ASTM #B-117) for 2000 hours. Two specimens of each pretreatment/coating systems were scribed with a figure "X" through the coating into the substrate. The top half of the "X" was in the Q Panel Coating Film area and the bottom half of the "X" was in the repaired area of the test specimens. A summary of the evaluation is provided in Table 8. Both pretreatments performed well for 2000 hours. The alodine panels passed with all three coating systems. The TUP passed with the two primers, however, it failed with the TT-P-2756 material. Subsequently, the coatings were carefully removed from the surface with a chemical stripper, without disturbing the underlying substrate. The panels were further examined. There was no evidence of underlying corrosion on the test panels coated with MIL-P-23377 and MIL-P-85582 on both pretreatments. With TT-P-2756 coating, the Touch Up Pen failed after 500 hours showing severe corrosion with Number 8 Blisters on both specimens of this pretreatment. The control Alodine panels with this coating passed 2000 hours with only slight corrosion.

TABLE 8 5% NaCl Salt Spray Results For Painted Panels

MIL-P-23377 Pretreatments	500 Hrs	1000 Hrs	1500 Hrs	2000 Hrs.	Results from stripped panels
Alodine (brush)	NC	NC	NC	VSC	
Alodine (brush) (stripped)	NC	NC	NC	VSC	Slight corr. on both sides of scribed area
Touch Up Pen	NC	NC	NC	NC	
Touch Up Pen (stripped)	NC	NC	NC	VSC	Slight corr. in scribe area. 1 pit near scribe in repair area.
MIL-P-85582 Pretreatments					
Alodine (brush)	NC	NC	NC	NC	
Alodine (brush) (stripped)	NC	NC	NC	NC	NC
Touch Up Pen	NC	NC	NC	VSC	
Touch Up Pen (stripped)	NC	NC	NC	VSC	Slight corr. along both sides of scribe but more on the repaired side.
TT-P-2756 Pretreatments					
Alodine (brush)	VSC	VSC	VSC	Slight corr.	
Alodine (brush) (stripped)	VSC	VSC	VSC	SC	Slight corr. on both sides of scribed area.
Touch Up Pen	Some #8 blisters severe corr.	One #4 blister severe corr.	One #2 blister severe corr.	Two #2&4 blisters severe corr.	
Touch Up Pen (stripped)	One #8 blister severe corr.	Three #4 blisters very severe corr.	Three #4 blisters very severe corr.	3 - #2&4 blisters very severe corr.	Slight corr in non-repaired scribed, but severe corr. & many pits on repaired side.

NC = No corrosion VSC = very slight corrosion

Summary

The chromate conversion coating film produced by the Hughes' Touch-Up Pen (TUP) failed to meet the corrosion resistant requirements MIL-C-5541 and MIL-C-81706. However, when applied to pre-conversion coated panels, the TUP coating passed the corrosion resistance requirements. In addition, the TUP failed to meet the adhesion and water resistance tests when coated with MIL-P-85582 and TT-P-2756. The TUP/MIL-P-23377 did, however, pass the adhesion requirements. When these tests were repeated on a repaired area, all three coating systems failed in the overlapping area between the Alodine coating and the area where the TUP was applied. This indicates a compatibility problem between the two conversion coating treatments.

The Hughes Pen passed 2000 hours in 5% salt spray when overcoated with MIL-P-85582 and TT-P-2756, but failed after 1000 hours with MIL-P-23377. When the tests were repeated on repaired specimens, MIL-P-23377 and MIL-P-85582 passed 2000 hours, but TT-P-2756 failed after 500 hours. Again, this indicates a compatibility problem with the TUP and the existing conversion coating treatment. The control specimens with Alodine passed 2000 hours with all three coatings in all tests.

Recommendations

1. At the present time, the Touch-Up Pen is not recommended for use in repair applications on naval aircraft. Additional development efforts are needed to solve the identified problems.

2. The compatibility problem between the Touch Up Pen and the Alodine CCC should be investigated. The pH of the solution in the pens is higher than typical CCC. This condition may be related to the compatibility problem and should be evaluated. The optimal coating weight and surface wetting characteristics should be determined for the TUP film in order to achieve the desired corrosion and adhesion performance properties. Finally, a better pen style should be develop to resolve the problem with the tips falling off during application.

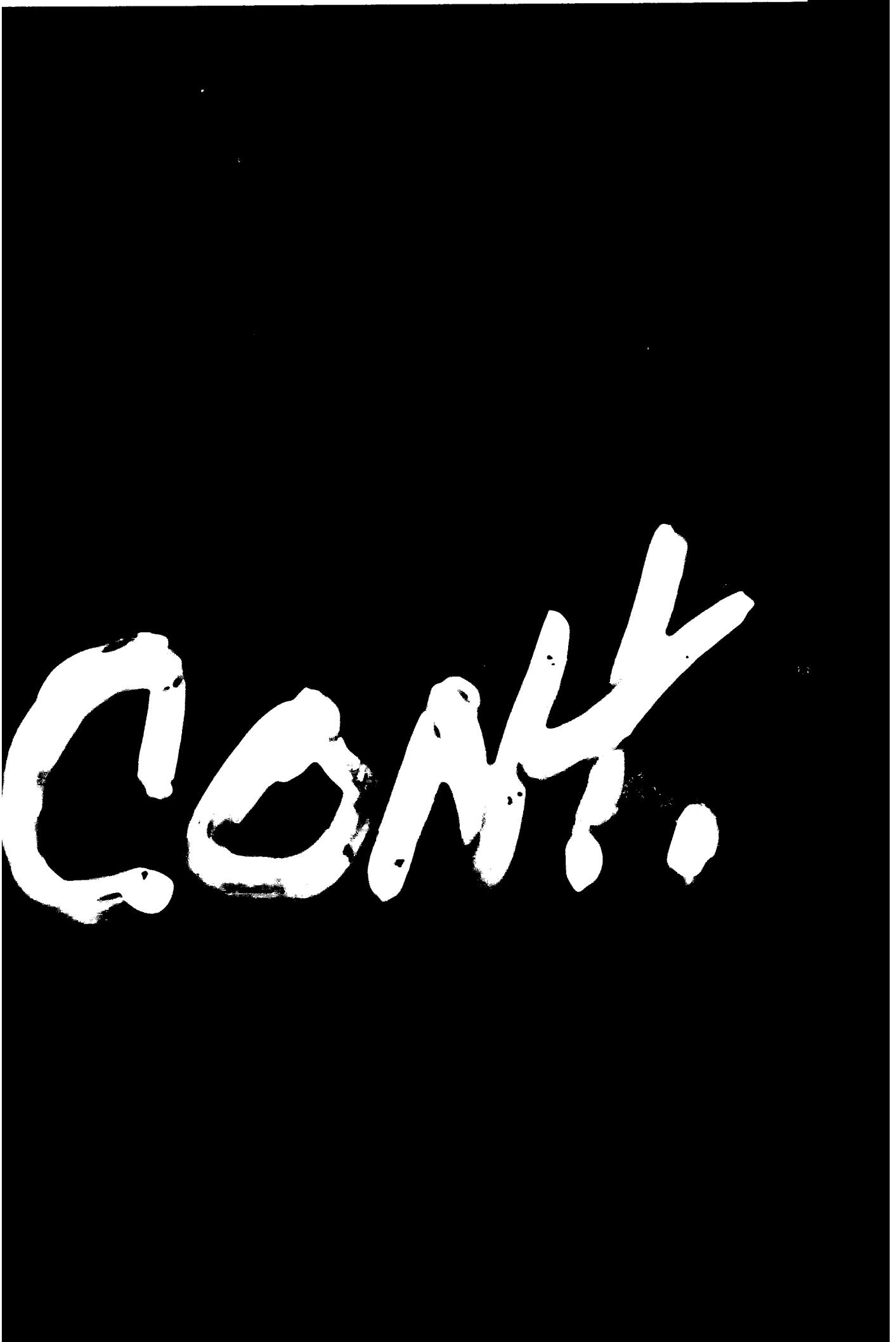
Acknowledgments

The authors would like to express their appreciation to Mr. William J. Green and Mr. Frank R. Pepe for their contributions to this effort. Without their dedication and inspiration, this work would not have been possible.

Naval Aviation Depot (343) Naval Air Station Norfolk, VA 23511-5188	1
Naval Aviation Depot (342) Naval Air Station Pensacola, FL 32508	1
Naval Aviation Depot (34210) Naval Air Station, North Island San Diego, CA 92135-5100	1
Naval Facilities Engineering Command (032, 18) Attn: J. Kaminski 200 Stoval St. Alexandria, VA 22332-2300	2
Naval Sea Systems Command (SEA-05M1) Washington, DC 20362	1
Office Of Naval Research (431, 12) 800 N. Quincy St. Arlington, VA 22217-5000	2
Warner-Robbins Air Logistics Command (MMEMC, MMTRC) Robbins AFB, GA 31098	2
Wright Aeronautical Laboratories (MLSA) Wright-Patterson AFB, OH 45433-6533	1
NAVAIRWARCENACDIVWAR (50 for 6062, 3 for 8131, 1 for 60C2)	54

DISTRIBUTION LIST

	Copies
Army Aviation Systems Command (DRDAV-DS) 4300 Goodfellow Blvd. St. Louis, MO 63120-1798	1
Army Belvoir Research & Development Center (STRBE-VO) Fort Belvoir, VA 22060-5606	1
Army Materials Command (AMCCE-BD) 5001 Eisenhower Ave. Alexandria, VA 22333	1
Army Research Laboratory (MS EMM) Watertown, MA 02172	1
David Taylor Research Center (2813, 2841) Annapolis, MD 21402-5067	2
Defense Technical Information Center Bldg #5, Cameron Station Attn: Administrator Alexandria, VA 22314	2
Hughes Ground Systems Group Attn: M. K. Unland Bldg 607, MS-b200 P.O. Box 3310 Fullerton, CA 92634-3310	1
Lead Maintenance Technology Center for Environment Naval Air Station Jacksonville, FL 32212-0016	1
Marine Corps Air Station (342) Cherry Point, NC 28533-5030	1
Naval Air Station (AIRLANT-528) Norfolk, VA 23511-5188	1
Naval Air Station, North Island (AIRPAC-7412) San Diego, CA 92135-5100	1
Naval Air Systems Command (AIR-41123, AIR-5304, AIR-09Y3) Washington, DC 20361	3
Naval Air Warfare Center (9321) Aircraft Division Lakehurst, NJ 08733-5100	1
Naval Aviation Depot (342) Naval Air Station Alameda, CA 94501	1
Naval Aviation Depot (343) Naval Air Station Jacksonville, FL 32212-0016	1


CONT.

SUPPLEMENTARY

INFORMATION

May 6, 1994

ERRATA

HUGHES

AEROSPACE AND DEFENSE SECTOR

Defense Technical Information Center
Bldg # 5, Cameron Station
Attn: Administrator
Alexandria, VA 22314

Subject: Evaluation of the Hughes Conversion Coating Touch-Up Pen, Report No. NAWCADWAR-93050-60

Chem-Film Pen Evaluator,

Our records indicate that you have received a copy of the subject report from the Naval Air Warfare Center in Warminster, Pennsylvania. Hughes brochures described the Chem-Film Pen as "***...meets U.S. Military Specifications (MIL-C-81706 and MIL-C-5541).***" The claim to meet MIL-C-81706 was based on the fact that the chemical used in the pen was from an approved supplier on the QPL for MIL-C-81706. Our claim to meet MIL-C-5541 was based on in-house testing. That testing showed that touching up scratches and damage on chem-filmed panels with the Hughes Chem-Film Pen allowed the panels to pass the corrosion resistance and paint adhesion of MIL-C-5541, Paragraphs 3.6 and 3.7.

We have recently been made aware, however, of the above evaluation that indicates that the coating applied by the pen does not meet all the requirements of both specifications. Although the testing was judged to be generally fair and impartial, part of the testing used the pen to apply the coating to the ***entire surface*** of the 3" x 6" or 3" x 10" bare aluminum test specimens.

The Hughes Touch Up Chem-Film Pen was never advertised nor intended to coat entire panels. In fact, the touch up provisions of MIL-C-5541 strictly limit the touch-up to "not more than 5%" of the panel. On page ten of the subject report under "Summary," the Hughes Chem-Film Pen (TUP) is described as follows: "***However, when applied to pre-conversion coated panels, the TUP passed the corrosion resistance requirements.***" Organizations outside of Hughes have tested and approved the use of the Hughes Chem Film Pen for its intended purpose, touching up minor scratches and imperfections on previously coated chem-film surfaces.

We still believe the application of chem-film by means of a pen type applicator is a viable means to apply touch up coating and reduce the hazardous waste associated with chem-film touch-up requirements. ***We can, however, no longer continue certifying the Chem-Film Pen to meet the requirements of MIL-C-81706 and MIL-C-5541.*** Users will need to make their own determinations regarding suitability of the pen for their applications

This information is being provided in order for you to make informed decisions on your continued or future use of this product. If you require further information please contact the undersigned at (714) 732-8286, or at the address printed below, directed to Materials and Processes Engineering, Building 607, Mail Stop B200.

E. Dean Johnston, Development Engineer Sr.

AD A278398

ERRATA

pen_ltr.pri

Post Office Box 3310 Fullerton, California 92634-3310
(714) 732-3232